Set up Borg A10 mark log for lab.

June 6, 2001 ~~October 1, 1999~~ ~~October 20, 1998~~

Determination of Permeability

~~by PPM 100~~ Borgwaldt A.P. Tester A10

Product Testing Laboratory

M. E. Counts

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* look over Cal data sheet

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I. A. Objective and Applicability

1. This procedure describes the process for determining permeability of fine papers using the Borgwaldt Air Permeability Tester A10 (A.P. Tester A10) equipped with a ~~special laminar~~ flow element for the measurement of banded cigarette papers. Results are reported in CORESTA units (CU).

2. This procedure is written specifically for the Physical Properties Laboratory within the Product Testing Laboratory. The following limitations apply to the use of this procedure for testing cigarette paper:

   a. The A.P. Tester A10 measurement range for an instrument with the standard flow element is 20 to 50,000 CU. The A.P. Tester A10 equipped with the low flow element is capable of measuring cigarette paper permeability lower than 20 CU.

   b. Standard (non-banded) cigarette papers may be measured on the A.P. Tester A10 using the standard 1 x 2 cm measuring head. Results obtained from the A.P. Tester A10 using the standard measuring head are comparable to results obtained from the Filtrona Paper Permeability Meter (PPM 100) using a 1 x 2 cm measuring head.

   c. The 2 x 15 mm rectangular measuring head should be used to measure the individual bands of banded cigarette papers.

3. Uncertainty.

II. B. Definitions

1. **Borgwaldt A.P. Tester A10** – The instrument is used to determine the permeability of paper in accordance with the International Standard ISO 2965. The unit employs the suction method and is suitable for measuring all common types of paper used in the production of cigarettes.

2. **Calibration Standards** — Four sintered metal standards labeled "A", "B", "C" & "D" which have a known flow rate in mL/min at a pressure drop across the standard of 1 kiloPascal (kPa). The standards must be calibrated by the Philip Morris Standards and Calibration Laboratory before use.

3. **CORESTA Value** — The unit of measurement for paper permeability by the CORESTA method. The dimensions on CORESTA values are cc/min/cm^2/kPa.

4. **Fine Papers** — The term used to describe cigarette papers, tipping papers, plug wrap, and perforated heat seal papers.

5. **Permeability** (CORESTA) — The ratio of the air flow (volume per unit time) per unit of surface area of the test paper to the difference in pressure across the test paper.

III. C. Apparatus

1. Borgwaldt Air Permeability Tester A10 fitted with a low flow element
2. Calibration Standards

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3. 2 x 15 mm measuring head for banded cigarette paper
4. 1 x 2 cm measuring head for non-banded cigarette paper
5. Blind plug and rubber membrane required for leak checking we need this
6. Video camera module (optional)
7. Printer and/or computer to display/collect data (optional)

IV. D. Sample Handling

Use of gloves is highly recommended to avoid transfer of skin oils to cigarette papers during handling.

1. Handle and transport all samples in a manner to minimize damage or alteration of samples. Avoid exposure of the samples to direct sunlight and extreme temperatures. Avoid handling the samples as much as possible, avoid contact with testing areas (e.g., skin oils absorbed by fine cigarette papers during handling will cause erroneous results) and use gloves or tweezers where necessary.

2. The sample size is ten cigarette papers for most programs, but depends on the facility sampling plan and/or test objectives.

3. Select the appropriate number of cigarettes to be tested, and assure the bar-code correctly matches the sample. Using the modified double-blade Sodim Ripper, rip the cigarettes down the seam and remove the tobacco, filter and seam. The seam must be removed to assure an air tight seal within the measuring head. Assure the cigarette paper is not damaged during this process. Place cigarette papers with bar-code in a sample container.

V. E. Calibration

WARNING: Inspect the power cords on the A.P. Tester A10 for frayed or damaged wires and broken plugs. Have defective wires or plugs replaced or repaired by qualified personnel. Check the power supply requirements against the name plate on the A.P. Tester A10. If there is any doubt about the power supply, plugs, or wiring, contact the facility electrician for assistance.

1. In order to ensure dependable and accurate measurement with the A.P. Tester A10, leak check and calibrate the instrument daily before measuring samples.

   a. It is recommended that instrument power and air supply remain on. If the instrument is turned off for any reason, allow the A.P. Tester A10 to warm up for a minimum of 4 hours prior to leak checking and calibration.

2. Leak check the A.P. Tester A10 before calibrating. See Appendix I, "Borgwaldt A.P. Tester A10 Leak Check Work Instructions."

3. Calibrate the A.P. Tester A10 daily before measuring samples. Repeat the calibration if problems with instrument operation occur, or if there is an interruption of the A.P. Tester A10

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power or air supply. See Appendix II, "Borgwaldt A.P. Tester A10 Calibration Work Instructions."

4. Calibration Run Charts

a. The flow rate values for any given standard and A.P. Tester A10 should remain relatively constant. Therefore, the recorded flow rate values for each standard can be plotted on a run chart to determine the validity of the A.P. Tester A10 calibration and the condition of the calibration standards.

b. To determine the limits for each standard, check the standard for approximately 20 consecutive workdays to determine the "normal" amount of variation in the calibration process. This should be carried out as soon as possible after the standards have been certified by a calibration laboratory. The A.P. Tester A10 instrument must also be operating properly. Maintain records in the instrument's logbook and identify the source of the data used to generate the limits.

c. After the limits have been determined for each standard, any flow rate value which exceeds the limits indicates that the A.P. Tester A10 instrument is not properly calibrated. This may be due to a malfunction of the instrument itself or may be due to a change in the calibration value of the standard. As a general rule, decreased flow rate is indicative of a partially blocked or dirty standard, and increased flow rate is characteristic of a cracked or damaged standard.

(1) If no leaks or other instrument problems are detected, return the calibration standard(s) to the calibration laboratory for re-certification.

(2) The occurrence of an unsuccessful calibration requires careful assessment of the quality of the data generated since the last calibration.

VI. F. Testing Procedures

See Appendix III, "Borgwaldt A.P. Tester A10 Sample Testing Work Instructions."

VII. G. Calculations

1. The A.P. Tester A10 computes the permeability of a sample within the instrument and displays the value. The permeability of a sample is given by the formula:

$$P = \frac{q}{(s)\,(\Delta p)}$$

where

P = the permeability of the sample in cubic centimeters per minute per square centimeter per kiloPascal. These units are usually called "CORESTA Units" (CU) for ease in communications.

q = the air flow passing through the test sample in cubic centimeters per minute (cc/min.).

s = the area of the sample actually tested in square centimeters (cm^2).

Δp = the pressure drop across the sample in kiloPascal (kPa).

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VIII. H. References

1.
2.
3.

IX. I. Revision History

1. 06/06/01 — Original document prepared by S. Laffoon and M. Smelley.

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Appendix I

Borgwaldt A.P. Tester A10 Leak Check Work Instructions

Leak check the A.P Tester A10 before calibration. Do not attempt to calibrate and run the instrument if leaks are detected.

1. Check the fine pressure controller gauge to assure air supply is set to 4.0 ± 0.2 bars. Maintenance personnel should make any necessary adjustments.
2. Check the complete unit for leakage.
   a. Close the air inlet, located on the measuring head, by inserting the blind plug.
   b. In the main menu, select **measure** by pressing "1."
   c. Select **manual** by first pressing → and then "1."

WARNING!
The unit (needle valve) may be damaged. Use the hand crank to carefully close and open the needle valve. Carefully turn the hand crank clockwise as far as it goes. Avoid closing or opening the valve with full power.

   d. Select measuring range #1 with the range button (located on lower right face of instrument).
   e. Start measurement by pressing the **Head Close** button or depressing the foot pedal.
   f. Turn the hand crank (large knob located on left front of measuring unit) until the displayed pressure is approximately 1000 Pa. Allow the flow to stabilize. Read several volume flow values in the display, or print by pressing "**C**." If the average volume flow value is less than 1 ml/min, the A.P. Tester A10 is leak free. Press "**A**" to cancel the measurement, and proceed with calibration.
3. Check measuring head and other components for leakage.
   a. If the average volume flow value is greater than 1 ml/min, use the rubber membrane to determine whether the sealing surfaces of the measuring head or other components are causing the leakage.
   b. Remove the blind plug from the air inlet and insert the rubber membrane into the measuring head and repeat steps 2.b. through 2.f. If the average volume flow is less than 0.5 ml/min, the sealing surface is leaking. Contact maintenance personnel to inspect and clean the measuring head.
   c. If the average volume flow is greater than 0.5 ml/min, the leak is in the measuring unit or the connecting hoses. Contact maintenance personnel to inspect the unit and connecting hoses.

Do not attempt to calibrate the instrument until all leaks are corrected and the leak check is successful.

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Appendix II

Borgwaldt A.P. Tester A10 Calibration Work Instructions

The instrument power and air supply should be left on. If not, allow to warm up for a minimum of 4 hours prior to calibration.

Use of gloves is mandatory to avoid transfer of contaminants to the sintered inner surface of the calibration standards. Any potential damage to the standards (e.g., dropped on a hard surface) must be documented and reported to supervision immediately.

The standards should be exposed to the same ambient climate as the A.P. Tester A10 for at least 12 hours prior to calibration. Keep the standards away from heat sources.

The A.P. Tester A10 must be checked for leakage before it is calibrated. Leaks can distort the calibration results.

1. Press the menu button (**Men**) to return to the main menu.
2. Press 4 for **tests**.
3. Press 1 for **calibrate**.
4. Disconnect the blue cable connecting the measuring head to the measuring unit. Slide the measuring head toward the operator, and disconnect the silicon tube that joins the protection filter to the unit.
5. Connect standard A to the unit at the measuring head connection and the blue receptacle.
6. Press the black range button (lower right face of the instrument) to select range #1.

Range selected?

7. Press **YES**.

cal. value: # # #.# % change?

8. Confirm that the value displayed is the same value printed on the standard, and press **NO**. If the value displayed is different from the value printed on the standard, contact supervision before proceeding with calibration.

Running

9. When the measurement of standard A is complete, the following message will appear.

difference: #.# % correction?

   If the difference is greater than ±2%, proceed with step 10. If the difference is equal to or less than ±2%, go to step 13.

10. Press **YES**.

repeat?

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11. Press **YES**.

range selected?

12. Repeat steps 7 through 9.
13. Press **NO**.

repeat?

14. Remove standard A and connect standard B.
15. Press the black range button to select range #2.
16. Press **YES**.

range selected?

17. Press **YES**.

cal. value: ###.# change?

18. Confirm that the value displayed is the same value printed on the standard, and press **NO**. If the value displayed is different from the value printed on the standard, contact supervision before proceeding with calibration.

Running

19. When the ~~reading~~ measurment of standard B is complete, the following message will appear.

difference: #.# % correction?

If the difference is greater than ±2%, proceed with step 20. If the difference is equal to or less than ±2%, go to step 23.

20. Press **YES**.

repeat?

21. Press **YES**.

range selected?

22. Repeat steps 17 through 19.
23. Press **NO**.

repeat?

24. Remove standard B and connect standard C.
25. Press the black range button to select range #3.
26. Press **YES**.

range selected?

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27. Press **YES**.

cal. value: ###.# change?

28. Confirm that the value displayed is the same value printed on the standard, and press **NO**. If the value displayed is different from the value printed on the standard, contact supervision before proceeding with calibration.

Running

29. When the ~~reading~~ measurement of the C standard is complete, the following message will appear.

difference: #.# % correction?

If the difference is greater than ±2%, proceed with step 30. If the difference is equal to or less than ±2%, go to step 33.

30. Press **YES**.

repeat?

31. Press **YES**.

range selected?

32. Repeat steps 27 through 29.

33. Press **NO**.

repeat?

34. Remove standard C and connect standard D.

35. Press the black range button to select range #4.

36. Press **YES**.

range selected?

37. Press **YES**.

cal. value: #####% change?

38. Confirm that the value displayed is the same value printed on the standard, and press **NO**. If the value displayed is different from the value printed on the standard, contact supervision before proceeding with calibration.

Running

39. When the ~~reading~~ measurement of standard D is complete, the following message will appear.

difference: #.# % correction?

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If the difference is greater than ±2%, proceed with step 40. If the difference is equal to or less than ±2%, go to step 43.

40. Press **YES**.

repeat?

41. Press **YES**.

range selected?

42. Repeat steps 38 through 40.

43. Press **NO**.

repeat?

44. Press **NO**.

45. Remove standard D and reconnect the measuring head.

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Appendix III

Borgwaldt A.P. Tester A10 Sample Testing Work Instructions

1. The values for most papers tested in our lab will be in range #1 (banded cigarette papers) or range #2 (non-banded cigarette papers). Using the black range button, select range #1 or range #2.
2. Press the menu button (**MEN**) to return to the main menu.
3. Press 1 to select **measure**.
4. Press 1 to select **series**.

identification

5. Scan the barcode or enter barcode identification manually using number keys. Press **RETURN**.

########## correct?

6. Verify that the barcode number was correctly entered and press **YES**. If incorrectly entered, press **NO**, and re-enter the number correctly using the number keys.

with program?

7. Press **NO**.

measuring of E?

8. Press **NO**.

start the measurement

9. Insert first paper. Push **Head Close** button or use foot pedal to close the measuring head.

1 ##.# good value?

10. Press **YES**.
11. Insert second paper. Push Head Close button or use foot pedal to close the measuring head. Continue until all papers for the current sample are tested.
12. The operator may reject some or all test results if there is an assignable cause (i.e., an operational error or a defect in the sample) which will impact the validity of the test results. The operator must document in Notes Editing, the reason for rejecting data.
    a. Accept all: Using the mouse, click **SAVE**.
    b. Flag a result: Click the cell in the flag column, which corresponds to the invalid result. Click **REJECT** in the drop-down menu. Click **SAVE**.
    c. Reject all: Click **CANCEL** to abort all values for a sample.

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13. When the current sample is complete, click the SAVE button in the Permeability computer menu.
14. Press **MEN** on the A.P. Tester A10. A report will print with mean, SD, etc.

Continue?

15. Press **NO.** The following menu will appear.

series * individual meas. curve * band meas.

16. To test the next sample, press 1 to select **series**.

identification

17. Repeat step 5 through step 16 for each sample tested.
18. Press **MEN** after all samples are tested.
19. After all samples are tested and results saved, the operator commits the data to the database. Click **COMMIT**.
20. The operator may commit all data sets or selected data sets.
    a. Commit selected data sets: Using the mouse, click the barcode for the data set to be committed, and click **ADD**. Repeat until all data sets are selected. Click **COMMIT**. Enter database login and password.
    b. Commit all data sets: Click **ADD ALL**. Click **COMMIT**. Enter database login and password.
21. Press the Windows 95 Start button, click on Shut Down..., and select Close all programs and log on as a different user.

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